

# **SARS-CoV-2 Sequencing and Variants in Washington State**

**Washington State Department of Health**

**July 13, 2022**

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# **SARS-CoV-2 Sequencing and Variants in Washington State**

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Next generation sequencing is a set of laboratory methods that scientists use to scan a viral genome to determine the genome sequence of a virus. A genome sequence of a virus is referred to as its “genomic fingerprint,” and can reveal mutations in a virus that make it unique. Mutations are changes in a genome sequence and occur naturally over time.

Scientists compare viral genomes to better understand how viruses can spread from person to person. Sequencing allows public health officials to detect clusters of cases, and monitor new lineages. Groups of same-species viruses that share a set of genome mutations are referred to as a lineage. Some lineages may have characteristics such as the ability to spread more quickly, or cause more severe disease. These lineages are classified as variants of interest, variants being monitored, or variants of high concern.

Throughout this report, we refer to the scientific name of the virus SARS-CoV-2 that causes COVID-19. Sequencing can only be performed on samples that are processed in laboratories and where swabs are stored in liquid that is compatible with sequencing, which means only samples used for molecular tests (such as PCR) can be included. For this reason, this report is limited to confirmed cases only. The genomes that are sequenced and compared are those of the virus, not humans.

### **At a glance (data through July 12, 2022)**

- During the month of June 2022, **6.2%** of all confirmed molecular COVID-19 cases were sequenced. This number is preliminary and will change over time as additional specimens are received from the previous month.
- **105,973 (9.0%)** COVID-19 cases in Washington state have sequencing information available since January 2021.

CDC currently categorizes variants as Variants of High Consequence (VOHC), Variants of Concern (VOC), Variants of Interest (VOI) and Variants Being Monitored (VBM). There are currently no VOHC and VOI so only VOC and VBM are detailed in this report.

## Variants of Concern

Variant	Area first detected	Background	Cumulative Washington cases detected	First detection in Washington*	Most recent detection in Washington*
Omicron (B.1.1.529 and BA lineages)	South Africa	Early research indicates evidence for increased transmissibility, immune evasion, and lower risk of hospitalization and death, relative to Delta. Approved vaccines are effective at preventing severe disease and death, including against the Omicron variant.	22,984	Nov 29, 21	Jun 25, 22

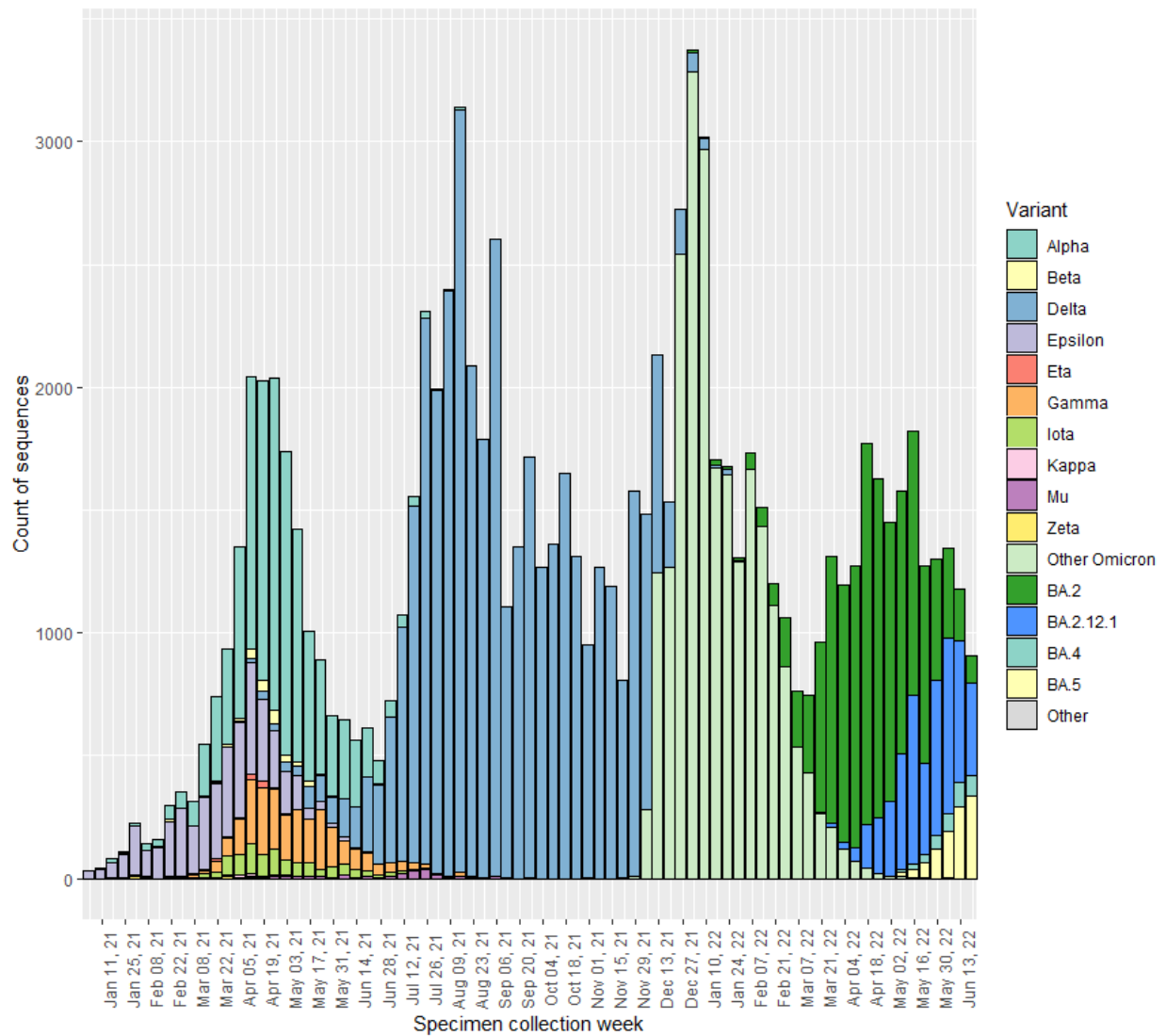
\*Detection dates are based on the date a sample is collected, it can take several weeks before a variant result is completed and added to the report

## Variants Being Monitored

Variant	Area first detected	First detection in Washington*
Alpha (B.1.1.7)	United Kingdom	1/7/2021
Beta (B.1.351)	South Africa	1/29/2021
Delta (B.1.617.2 and AY lineages)	India	4/3/2021
Epsilon (B.1.427 / B.1.429)	California	12/11/2020
Eta (B.1.525)	New York	2/2/2021
Gamma (P.1)	Brazil	2/6/2021
Iota (B.1.526)	New York	1/21/2021
Kappa (B.1.617.1)	India	3/22/2021
Mu (B.1.621)	Colombia	4/9/2021
Zeta (P.2)	Brazil	1/18/2021

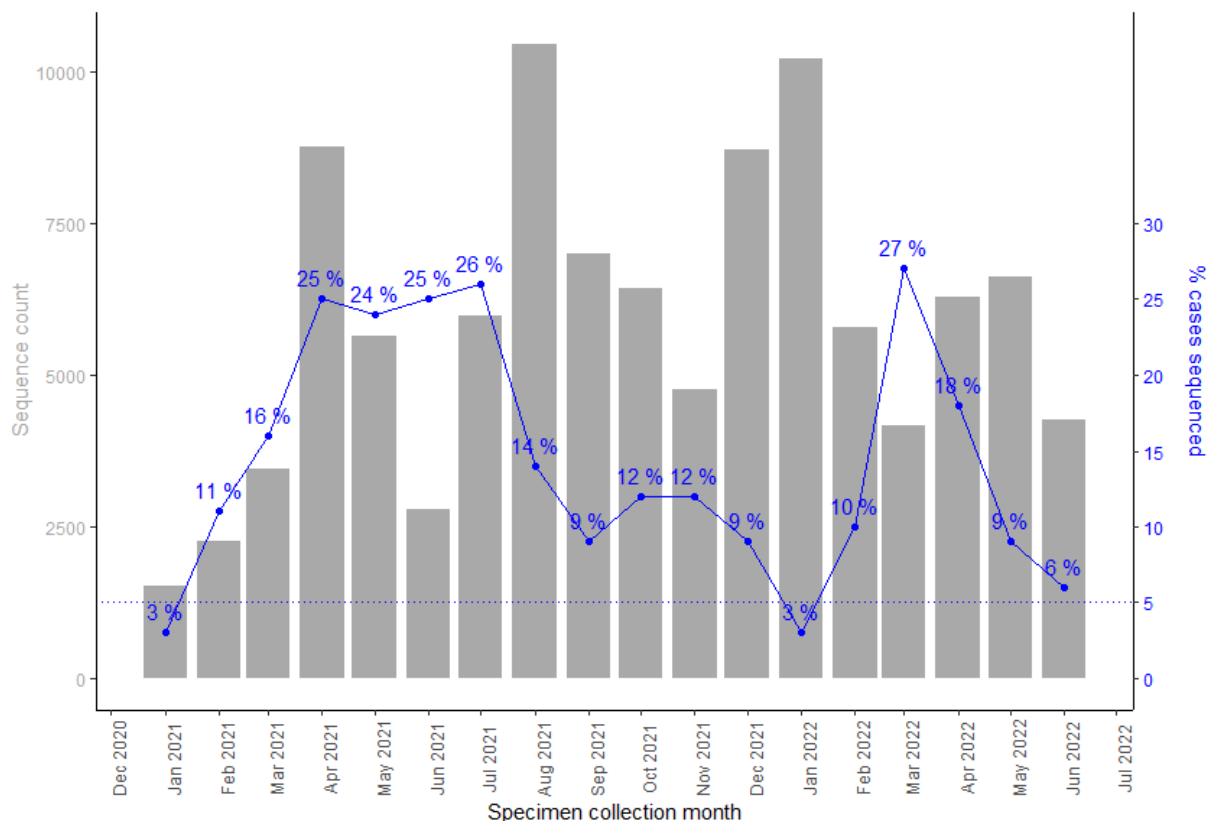
\*Detection dates are based on the date a sample is collected, it can take several weeks before a variant result is completed and added to the report

## Epidemiologic curve of variants being monitored and variants of concern by week of specimen collection date from January 01, 2021 to July 02, 2022



- The above graph shows the total number of variants detected by the week the specimen was collected from a patient.
- Sequencing can be performed on stored patient specimens at any time, so these numbers may change as additional specimens are sequenced.
- This graph shows all specimens sequenced, including specimens sequenced during outbreaks and other targeted sequencing efforts.
- "Other Omicron " includes B.1.1.529, BA.1 and BA.3 sublineages

**Number of specimens sequenced, and percent of Washington State confirmed COVID-19 cases that have been sequenced by specimen collection date from January 2021 through June 2022.**

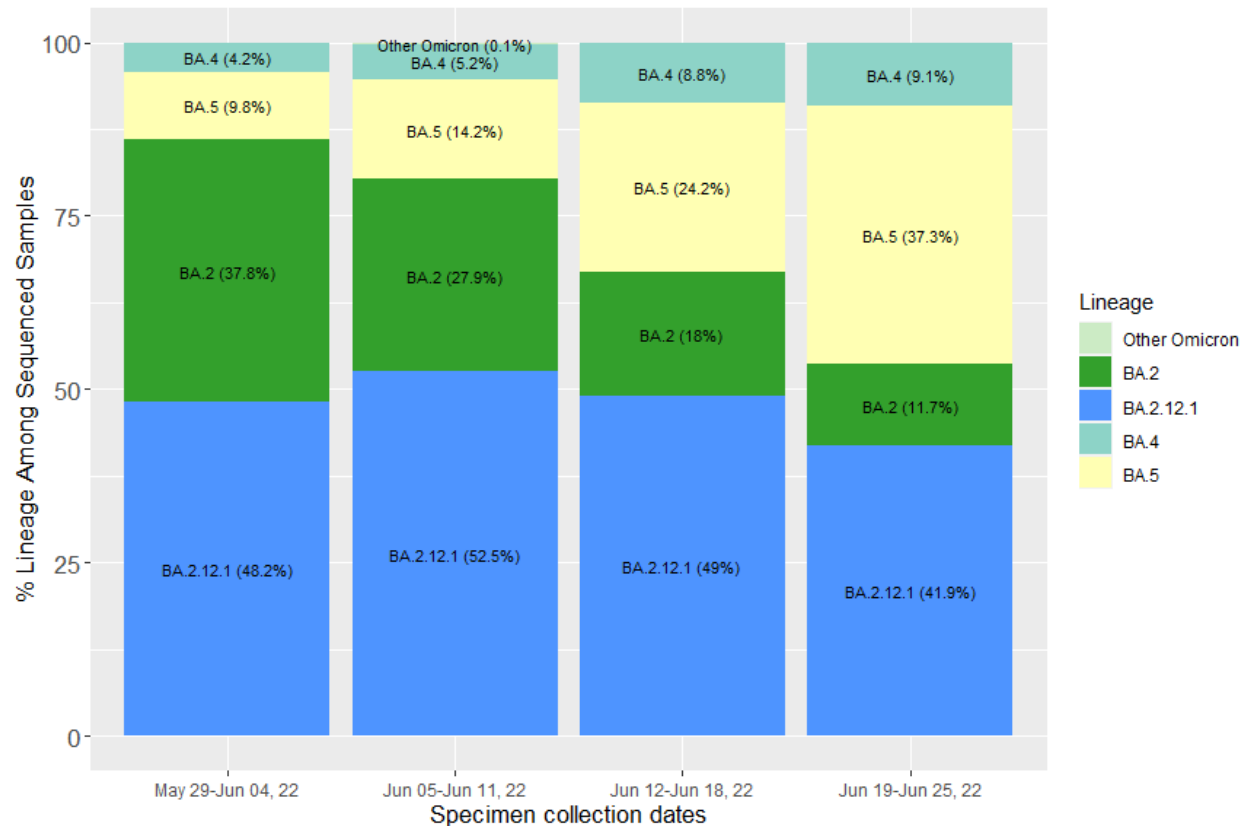


- Samples are not sequenced for every confirmed COVID-19 case. The above graph shows the total number of specimens sequenced (gray bars) and the percent of all confirmed cases (blue line) that have had sequencing performed each month. Data from the previous month may still be incomplete.
- Sequencing can be performed on stored specimens at any time, so numbers from past months may change if stored specimens are sequenced.

## SARS-CoV-2 Lineages Circulating in Washington State

The graph below shows the change in proportion of select SARS-CoV-2 lineages by time period. A viral lineage is a group of viruses that descend from a common ancestor with shared genetic characteristics, allowing them to be grouped together. As the proportions of variants increase, the proportion of other lineages will decrease.

NOTE: The data on this graph come from cases that are randomly selected for sequencing statewide, Cases sequenced because they were part of an outbreak or were otherwise manually selected for sequencing are excluded.



The chart above shows the proportions of the most common SARS-CoV-2 lineages circulating in Washington grouped in one-week intervals. Proportions are calculated using data which are subject to change over time and will be updated as more data becomes available, including data from prior time periods. **Due to the time it takes to complete sequencing, the most recent time period is based on a very small number of sequences and likely to be adjusted over time.**

To see the national trends, visit the CDC's [variant proportions page](#).

**The table below shows the current number of variants of concern (VOC) detected by county of home address since January 2022.**

County	VOC					Total current VOC specimens sequenced
	Other Omicron	BA.2	BA.2.12.1	BA.4	BA.5	
Adams	65	2	1	0	1	69
Asotin	14	2	3	0	0	19
Benton	559	92	36	1	7	695
Chelan	171	59	54	1	10	295
Clallam	212	170	41	3	9	435
Clark	347	269	84	7	11	718
Columbia	6	1	0	0	0	7
Cowlitz	320	85	31	2	3	441
Douglas	113	38	21	1	2	175
Ferry	10	3	2	0	0	15
Franklin	472	35	21	1	5	534
Garfield	0	1	1	0	0	2
Grant	269	21	18	1	1	310
Grays Harbor	398	89	32	5	5	529
Island	70	116	23	3	9	221
Jefferson	68	12	6	0	2	88
King	6,623	7,143	2,183	174	428	16,551
Kitsap	276	205	49	6	9	545
Kittitas	68	17	4	0	0	89
Klickitat	18	4	2	0	0	24
Lewis	251	20	8	0	1	280
Lincoln	6	3	0	0	1	10
Mason	112	33	7	1	1	154
Okanogan	142	16	22	0	0	180



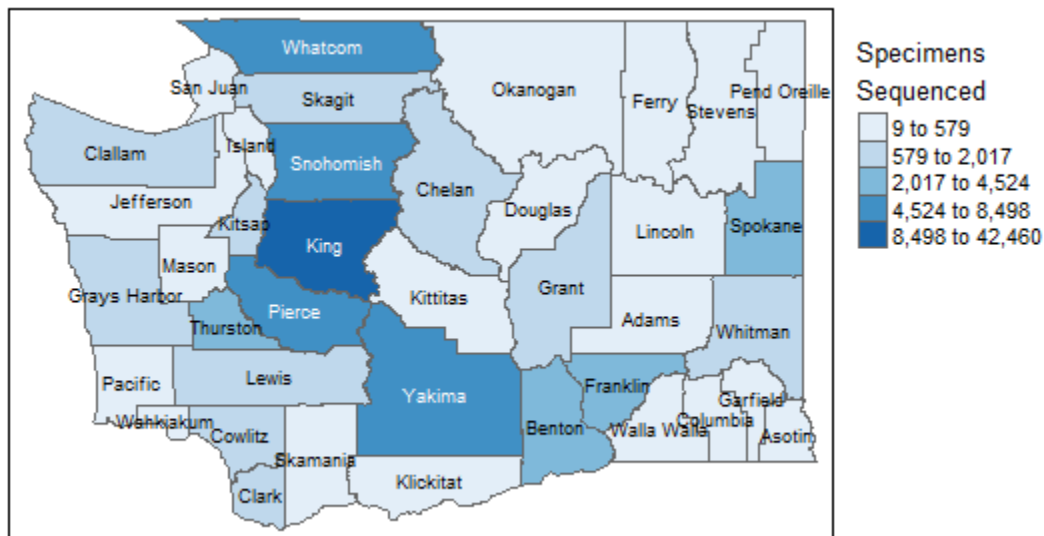
	VOC					
County	Other Omicron	BA.2	BA.2.12.1	BA.4	BA.5	Total current VOC specimens sequenced
Pacific	111	13	13	0	0	137
Pend Oreille	13	1	1	0	0	15
Pierce	1,242	681	215	16	39	2,193
San Juan	16	5	2	0	0	23
Skagit	167	290	93	16	24	590
Skamania	6	0	1	0	1	8
Snohomish	1,117	1,399	388	16	82	3,002
Spokane	710	162	87	0	6	965
Stevens	28	2	1	0	1	32
Thurston	1,242	225	90	4	21	1,582
Wahkiakum	7	6	0	0	0	13
Walla Walla	170	27	46	0	1	244
Whatcom	632	1,272	443	33	82	2,462
Whitman	188	57	18	1	0	264
Yakima	1,349	112	53	3	5	1,522

- In this table, “Other Omicron” includes all B.1.1.529, BA.1, and BA.3 sublineages

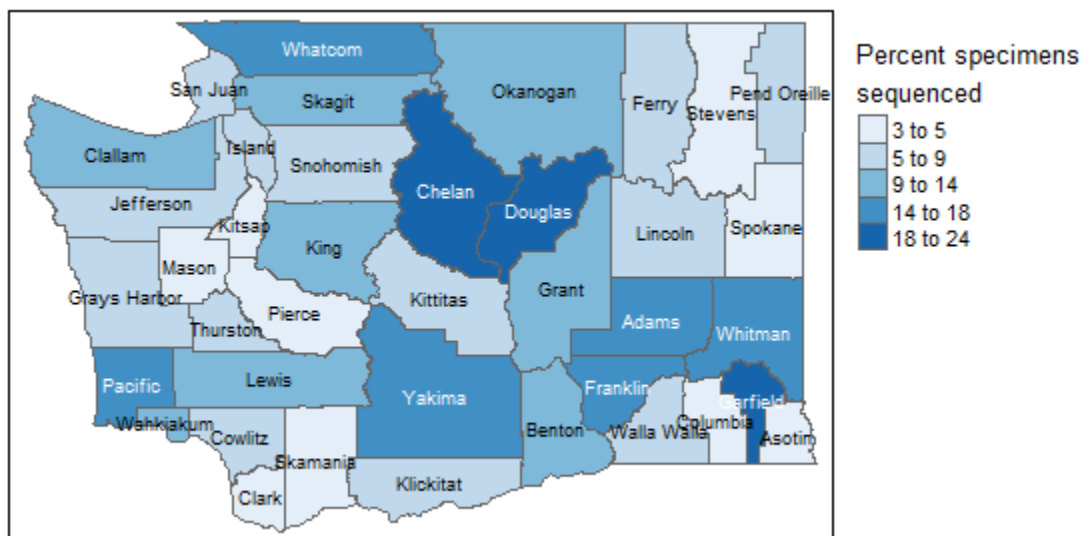
## Geographic Coverage of Sequencing

Efforts are made to sequence specimens from all geographic areas of Washington State. The number of sequences and the percent of cases sequenced vary based on several factors including which laboratories conduct the majority of testing in each locality.

**The map below shows the number of specimens sequenced by county of home address since January 1, 2021.**



**The map below shows the percent of COVID-19 cases with at least one specimen sequenced by county of home address since January 1, 2021.**



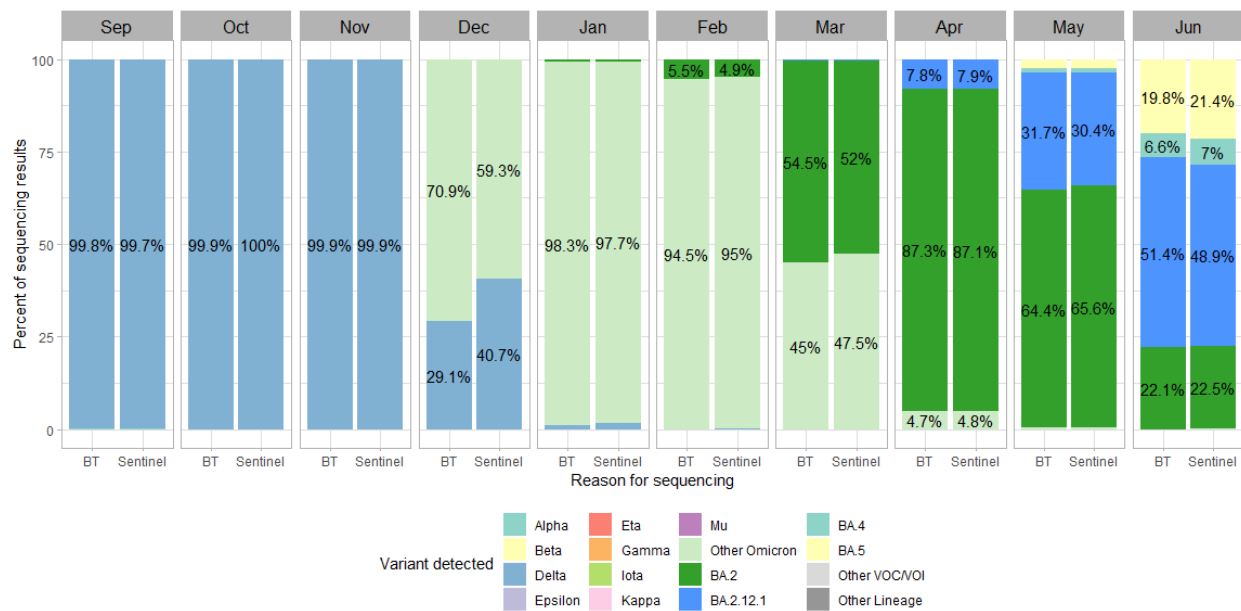
## Vaccine Breakthrough Cases

A complete report on vaccine breakthrough cases can be found in the reports section of the [DOH data dashboard](#).

A vaccine breakthrough case is defined as someone who tests positive for SARS-CoV-2 at least 14 days after their final dose of SARS-CoV-2 vaccine. DOH is monitoring sequencing results for vaccine breakthrough cases. This can help scientists determine whether any specific variants of the virus are causing more breakthrough cases than expected.

The table and chart below show vaccine breakthrough cases based on lineages. Lineages not designated as VOC, VOI or VBM are marked as 'other'.

**Proportion of variants identified among vaccine breakthrough cases (Breakthrough) with sequencing results compared to variants identified among randomly selected COVID-19 cases (Sentinel) during the same time frame**



### Breakthrough cases by variant table

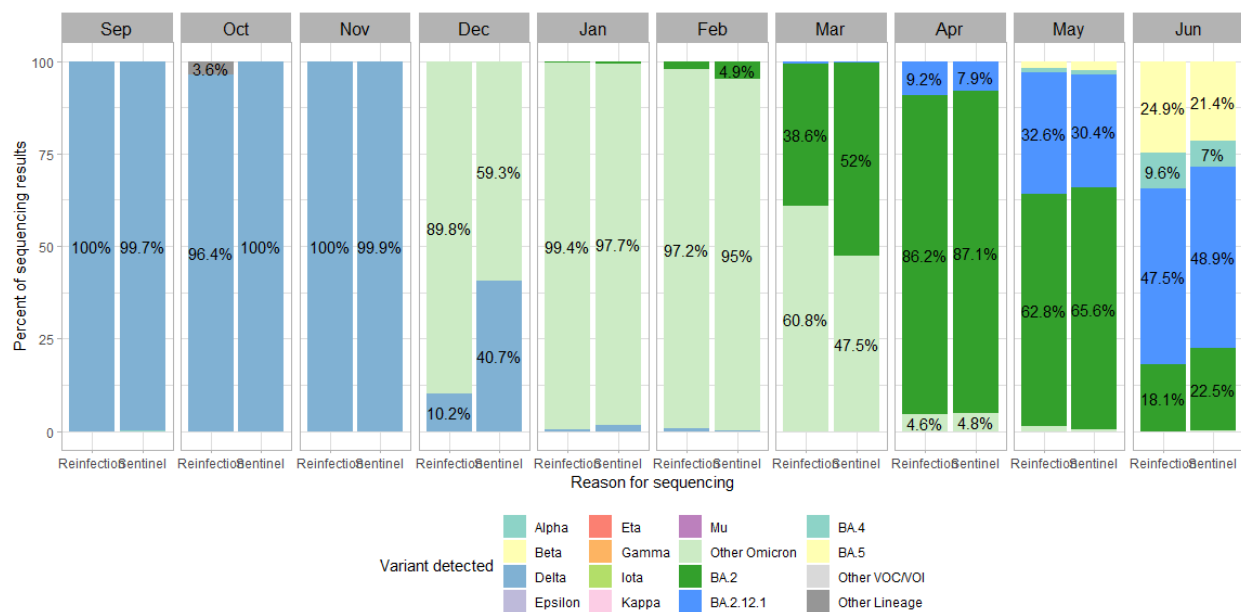
Variant	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Alpha	1	0	0	0	0	0	0	0	0	0
Delta	2,299	2,460	1,857	1,465	60	0	0	0	0	0
Gamma	0	0	0	1	0	0	0	0	0	0
Other Omicron	0	0	1	3,569	6,093	3,526	1,426	232	17	0
BA.2	0	0	0	0	43	206	1,727	4,269	3,111	551
BA.2.12.1	0	0	0	0	0	0	12	383	1,530	1,285
BA.4	0	0	0	0	0	0	0	1	57	164
BA.5	0	0	0	0	0	0	0	1	109	495
Other VOC/VOI	3	0	0	0	0	0	0	0	0	0
Other Lineage	0	2	1	2	4	1	6	3	9	3

## Reinfection

A complete report on reinfection cases can be found in the reports section of the DOH data dashboard.

In general, reinfection means a person was infected once with the virus that causes COVID-19, recovered, and then later became infected again. We are still learning about COVID-19 and the duration and strength of immunity following infection with this virus. Based on what we know from similar respiratory viruses, we expect some COVID-19 reinfections to occur. For disease surveillance purposes, a person with a reported reinfection is an individual with two positive COVID-19 test results (molecular or antigen) reported to DOH where the tests were performed at least 90 days apart. In addition, if genetic sequencing of respiratory samples from a patient's first (or primary) infection and most recent infection identifies different variants, they are considered a confirmed reinfection regardless of the amount of time between positive tests. Washington State Department of Health adopted this definition on September 1, 2021.

DOH is monitoring sequencing results for reinfection cases. This can help scientists determine whether any specific variants of the virus are causing more reinfection cases than expected. The table and chart below show reinfection cases based on lineages. Lineages not designated as VOC, VOI or VBM are marked as 'other'. Proportion of variants identified among reinfection cases (Reinfection) with sequencing results compared to variants identified among randomly selected COVID-19 cases (Sentinel) during the same time frame.



## Reinfection cases by variant table

Please note - data for the most recent month are incomplete

Variant	Jun	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Delta	0	32	54	47	28	2	2	0	0	0
Other Omicron	0	0	0	0	247	635	311	104	10	4
BA.2	32	0	0	0	0	1	7	66	188	177
BA.2.12.1	84	0	0	0	0	0	0	1	20	92
BA.4	17	0	0	0	0	0	0	0	0	4
BA.5	44	0	0	0	0	0	0	0	0	5
Other Lineage	0	0	2	0	0	1	0	0	0	0

The hospitalization table below includes data since January 1, 2021 and does not account for factors that can influence hospitalization rates such as age and vaccination status, which may be different across variants. This means that hospitalization rates are not necessarily comparable between variants.

### Hospitalizations and deaths by variant

Variant	Cases who were hospitalized	Cases who died from COVID-19	Total cases
Other Omicron	1.3%	0.5%	22,879
BA.2	1%	0.1%	12,689
BA.2.12.1	1.4%	0.1%	4,100
BA.4	0.7%	0%	295
BA.5	1.2%	0.4%	767
Alpha	3.4%	0.6%	10,274
Beta	7.1%	1.1%	280
Delta	4.3%	1.3%	38,591
Epsilon	2.6%	0.7%	4,144
Gamma	6.9%	1.8%	2,472
Iota	3.1%	1.3%	928
Mu	2.8%	1.9%	212
Other	2.5%	0.7%	4,928

### Age distribution by variant

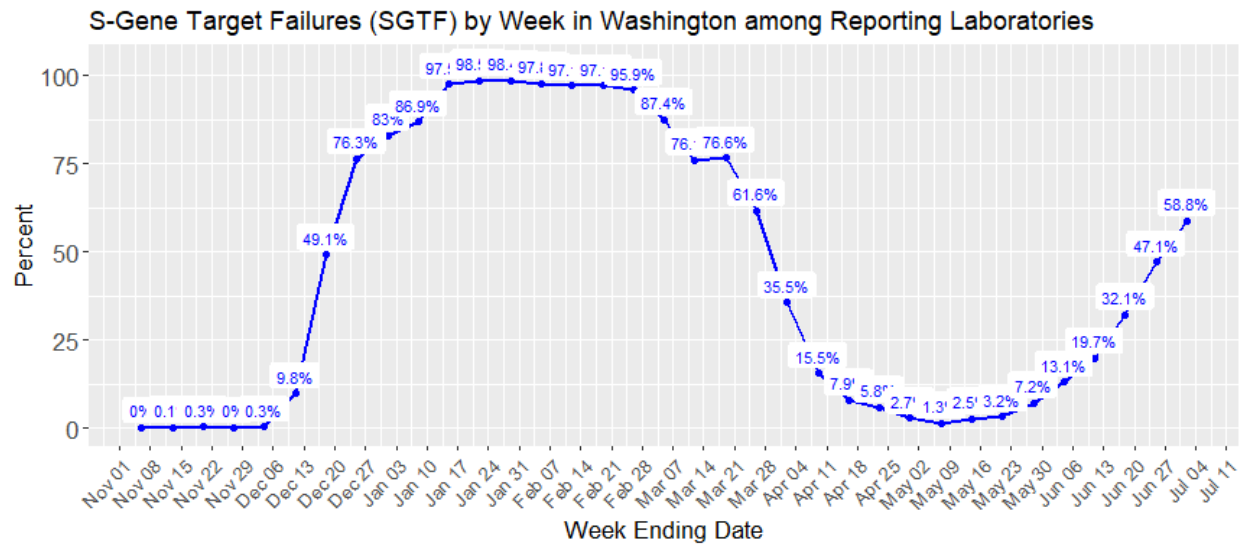
Variant	Age 0-19	Age 20-34	Age 35-49	Age 50-64	Age 65-79	Age 80+	Unknown	Total cases
Other Omicron	24%	32%	22%	13%	5%	2%	2%	22,879
BA.2	19%	32%	23%	14%	8%	2%	2%	12,689
BA.2.12.1	17%	32%	22%	14%	9%	3%	2%	4,100
BA.4	26%	33%	17%	14%	7%	1%	2%	295
BA.5	12%	32%	25%	16%	9%	3%	3%	767
Alpha	27%	32%	22%	12%	3%	1%	2%	10,274
Beta	29%	34%	21%	12%	3%	0%	1%	280
Delta	23%	29%	22%	14%	7%	2%	2%	38,591
Epsilon	25%	31%	22%	14%	4%	1%	2%	4,144
Gamma	22%	35%	23%	11%	4%	3%	2%	2,472
Iota	25%	33%	24%	12%	4%	1%	1%	928
Mu	23%	36%	22%	10%	6%	1%	2%	212
Other	24%	29%	22%	15%	5%	2%	2%	4,928

\*Other includes all variant viruses that are not categorized as VOC or VBM



## Tracking Omicron Using Clinical Tests

WA DOH is tracking the Omicron variant using sequencing. One challenge is that the sequencing process can take up to a few weeks, so we use another testing marker known as 'S gene target failure (SGTF)' to identify possible Omicron cases carrying this mutation rapidly and inform public health action; these include BA.1, BA.3, BA.4 and BA.5 and sublineages. BA.2 and BA.2.12.1 do not carry this mutation. While SGTF does not always mean that a case will be finalized as Omicron, greater than 95% of these results are predicted to finalize as Omicron. Many laboratories are sharing this data with WA DOH to help track the spread of Omicron.



A small number of other SARS-CoV-2 viruses other than Omicron can cause SGTF, these can be seen in the small numbers (0-3) seen weekly prior to the week of November 28th.

First Day of Week	Last Day of Week	Total Positives	Total SGTF	Percent SGTF
2021-10-31	2021-11-06	1,086	0	0%
2021-11-07	2021-11-13	1,093	1	0.1%
2021-11-14	2021-11-20	1,129	3	0.3%
2021-11-21	2021-11-27	1,267	0	0%
2021-11-28	2021-12-04	2,414	8	0.3%
2021-12-05	2021-12-11	2,342	229	9.8%
2021-12-12	2021-12-18	3,162	1,552	49.1%
2021-12-19	2021-12-25	4,528	3,456	76.3%
2021-12-26	2022-01-01	5,033	4,178	83%
2022-01-02	2022-01-08	10,893	9,469	86.9%
2022-01-09	2022-01-15	13,481	13,149	97.5%
2022-01-16	2022-01-22	11,754	11,581	98.5%
2022-01-23	2022-01-29	8,363	8,233	98.4%
2022-01-30	2022-02-05	4,686	4,581	97.8%
2022-02-06	2022-02-12	2,696	2,619	97.1%
2022-02-13	2022-02-19	1,372	1,332	97.1%
2022-02-20	2022-02-26	627	601	95.9%
2022-02-27	2022-03-05	478	418	87.4%
2022-03-06	2022-03-12	355	270	76.1%
2022-03-13	2022-03-19	334	256	76.6%
2022-03-20	2022-03-26	375	231	61.6%
2022-03-27	2022-04-02	332	118	35.5%
2022-04-03	2022-04-09	381	59	15.5%
2022-04-10	2022-04-16	544	43	7.9%
2022-04-17	2022-04-23	762	44	5.8%
2022-04-24	2022-04-30	1,143	31	2.7%
2022-05-01	2022-05-07	1,190	15	1.3%
2022-05-08	2022-05-14	1,419	36	2.5%
2022-05-15	2022-05-21	1,602	51	3.2%
2022-05-22	2022-05-28	1,516	109	7.2%

First Day of Week	Last Day of Week	Total Positives	Total SGTF	Percent SGTF
2022-05-29	2022-06-04	1,295	169	13.1%
2022-06-05	2022-06-11	1,270	250	19.7%
2022-06-12	2022-06-18	1,167	375	32.1%
2022-06-19	2022-06-25	1,236	582	47.1%
2022-06-26	2022-07-02	1,092	642	58.8%

We thank the reporting laboratories: University of Washington Virology, Northwest Laboratories, The Vancouver Clinic, Atlas Laboratories, Evergreen Health, FidaLab

We gratefully acknowledge the laboratories that tested and sequenced the specimens for reporting the sequencing metadata including the lineages to WA DOH. We also thank the GISAID initiative as the whole genome sequencing data stored in their repository has helped us validate the submissions we receive from laboratories.

**The following clinical laboratories have contributed specimens for sequencing:**

Aegis Sciences Corporation  
Allenmore Hospital Laboratory  
Altius Institute for Biomedical Sciences  
Atlas Genomics  
BioReference Laboratories Inc.  
Cascade Valley Hospital  
Central Washington Hospital  
Columbia Basin Hospital  
Curative Labs Inc.  
Dayton General Hospital  
Deaconess Hospital  
Diatherix Laboratories  
Dynacare Northwest Inc.  
East Adams Rural Hospital  
Everett Clinic Microbiology  
Evergreen Healthcare  
Ferry County Hospital  
FidaLab  
Forks Community Hospital  
Fulgent Genetics  
Gravity Diagnostics, LLC  
Harborview Medical Center  
Healthquest Esoterics  
Helix/Illumina  
Incyte Diagnostics Spokane  
Infinity Biologix  
Interpath Laboratory  
Jefferson Healthcare

Kaiser Permanente Washington Health Research Institute  
Labcorp  
Laboratories Northwest  
Laboratory Corporation of America  
Legacy Laboratory  
Magnolia Diagnostics, LLC  
Mann-Grandstaff VA Medical Center  
Mason General Hospital Laboratory  
Mid Valley Hospital  
Molecular Testing Labs  
MultiCare  
Northwest Laboratories  
Northwest Laboratories  
OHSU Lab Services Molecular Microbiology Lab  
Olympic Medical Center  
Overlake Hospital  
PeaceHealth  
Polyclinic  
Premier Medical Laboratory  
Providence Medical Group  
Public Health Seattle-King County Laboratory  
Quest Diagnostics Incorporated  
Samaritan Hospital Lab  
Seattle & King County Public Health Lab  
Seattle Children's Hospital  
Seattle Flu Study  
Skagit Valley Hospital Laboratory  
St. Francis Hospital

St. Joseph Medical Center Microbiology  
St. Michael Medical Center Laboratory  
Swedish Medical Center  
Tacoma General Hospital  
The Vancouver Clinic  
Tomorrow's Health, LLC  
TridentCare Laboratory  
TridentCare Laboratory  
University of Washington Virology Lab  
Virginia Mason Franciscan Health Microbiology  
Washington State Department of Health Public Health Laboratories

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**The following labs have reported sequencing data that is included in this report:**

Aegis Laboratory  
Altius Institute for Biomedical Research  
Atlas Genomics  
Boise VA Medical Center  
Centers for Disease Control and Prevention  
Curative  
Flow Diagnostics  
Fulgent Genetics  
Ginkgo Bioworks Clinical Laboratory  
Gravity Diagnostics, LLC  
Gritman Medical Center  
Grubaugh Lab  
Helix Laboratories  
Idaho Bureau of Laboratories  
Infinity Biologix  
Institute for Systems Biology  
Kaiser Permanente  
Laboratory Corporation of America  
Montana Public Health Laboratory  
Naval Health Research Center  
Oregon SARS-CoV-2 Genome Sequencing Center  
Oregon State Public Health Laboratory  
Providence St. Joseph Health Molecular Genomics Laboratory  
Quest Diagnostics  
Seattle Flu Study  
The Jackson Laboratory  
The Loring Laboratory  
United States Army Medical Research Institute of Infectious Diseases



University of Washington Virology Lab

Washington State Department of Health Public Health Laboratories

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